Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A drilling system, comprising:

a stationary base table for supporting a work piece under process at a fixed position at a drilling spindle station;

a drilling spindle for carrying and applying rotational force to a drilling tool;

a compound overhead guiding system that carries the spindle above the work piece under process, said system including a Y-axis guiding structure for guiding movement of the spindle along a Y axis in relation to the base table, an X drive system for driving the spindle along an X axis which is orthogonal to said Y axis, and a Z axis drive system for driving the drilling tool along a Z axis which is orthogonal to said X and Y axis;

said guiding system comprising a lightweight crossbeam structure for carrying the spindle and X axis drive system, said crossbeam structure comprising a laminated assembly comprising a first hollow structural element having high torsional strength and a second hollow structural element having high bending strength.

2. (Original) The system of Claim 1, wherein the Z axis drive system comprises a linear Z-axis drive motor which acts on a spindle rotor to drive the rotor along the Z-axis relative to a stationary spindle body.

3. (Original) The system of Claim 1, further comprising a Y-axis drive system coupled to the guiding system for driving the crossbeam structure in the Y-axis.

4. (Original) The system of Claim 3, wherein the Y-axis drive system comprises a motor-driven leadscrew.

5. (Original) The system of Claim 3, wherein the Y-axis drive system comprises a linear motor.

6. (Original) The system of Claim 1, wherein the X-axis drive system comprises a leadscrew.

7. (Original) The system of Claim 1, wherein the X-axis drive system comprises a linear motor.

8. (Original) The system of Claim 1, wherein the compound overhead guiding system comprises:

a movable overhead Y-carriage structure which is bearing mounted relative to the base table for translating movement along the Y-axis.

9. (Original) The system of Claim 1, wherein the guiding structure comprises a T-bar structure which includes:

a Y-carriage structure having a longitudinal extent along the Y axis; and

said crossbeam structure, wherein said crossbeam structure is perpendicularly attached to the Y-carriage structure and has a longitudinal extent along the X axis.

10. (Original) The system of Claim 1, wherein the first hollow structural element comprises a thin-walled round tubing structure, and the second hollow structural element comprises a thin-walled square tubing structure, the round tubing structure fitted into the square tubing structure so that an outer surface of the round tubing structure is in tangential contact with an inner surface of the square tubing structure.

11. (Original) The system of Claim 1, further comprising a low impact pressure foot system carried by said spindle for applying a clamping force against a surface of a work piece during a drilling stroke, the pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke spaced above the work piece;

a movable clamp member carried by the body structure; and

an actuator for applying a clamp force to move the clamp member against the surface of the work piece at commencement of a drilling stroke and moving the clamp member away from the surface at the end of a drilling stroke.

12. (Original) The system of Claim 11, wherein the clamp member is a relatively low mass finger element having an opening formed therein to allow passage of the drill bit during a drilling stroke, said finger element hingedly connected to the body structure.

13. (Original) The system of Claim 12, wherein the actuator comprises a pneumatic valve and an inflatable bladder element, the valve for selectively inflating and deflating the bladder element to apply the clamp force.

14. (Original) A drilling system, comprising:

a stationary base table for supporting a plurality of work pieces under process at respective fixed positions at a drilling spindle station;

a plurality of drilling spindles each for carrying and applying rotational force to a drilling tool, the respective drilling spindles including a Z-axis drive system for applying reciprocating movement along a Z-axis to the drilling tool;

a compound overhead guiding system that carries the plurality of spindles above the work piece under process, said system including a Y-axis guiding structure for guiding movement of the spindles along a Y axis in relation to the base table, and an X drive system for driving the spindles along an X axis which is orthogonal to said Y axis;

said guiding system comprising a lightweight crossbeam structure for carrying the spindle and X axis drive system, said crossbeam structure comprising a laminated assembly comprising a first hollow structural element having high torsional strength and a second hollow structural element having high bending strength.

15. (Original) The system of Claim 14, wherein the Z axis drive system comprises a linear Z-axis drive motor which acts on a spindle rotor to drive the rotor along the Z-axis relative to a stationary spindle body.

16. (Original) The system of Claim 14, further comprising a Y-axis drive system coupled to the guiding system for driving the crossbeam structure in the Y-axis.

17. (Original) The system of Claim 16, wherein the Y-axis drive system comprises a motor-driven leadscrew.

18. (Original) The system of Claim 16, wherein the Y-axis drive system comprises a linear motor.

19. (Original) The system of Claim 14, wherein the X-axis drive system comprises a leadscrew.

20. (Original) The system of Claim 14, wherein the X-axis drive system comprises a linear motor.

21. (Original) The system of Claim 14, wherein the compound overhead guiding system comprises:

a movable overhead Y-carriage structure which is bearing mounted relative to the base table for translating movement along the Y-axis.

22. (Original) The system of Claim 14, wherein the guiding structure comprises a T-bar structure which includes:

a Y-carriage structure having a longitudinal extent along the Y axis; and

said crossbeam structure, wherein said crossbeam structure is perpendicularly attached to the Y-carriage structure and has a longitudinal extent along the X axis.

23. (Original) The system of Claim 14, wherein the first hollow structural element comprises a thin-walled round tubing structure, and the second hollow structural element comprises a thin-walled square tubing structure, the round tubing structure fitted into the square tubing structure so that an outer surface of the round tubing structure is in tangential contact with an inner surface of the square tubing structure.

24. (Original) The system of Claim 23, wherein the round tubing structure is fixed to the square tubing structure by an adhesive.

25. (Original) The system of Claim 14, wherein the round tubing structure and the square tubing structure are fabricated of a steel.

26. (Original) The system of Claim 25, wherein the round tubing structure has a nominal wall thickness of 0.060 inch, and the square tubing structure has a nominal wall thickness of 0.078 inch.

27. (Original) The system of Claim 23, further comprising a dampening material disposed in spaces between the round tubing structure and the square tubing structure.

28. (Original) The system of Claim 23, wherein the crossbeam structure further comprises a plate attached to an outer wall of the square tubing structure.

29. (Original) The system of Claim 23, wherein the crossbeam structure further comprises an elastomer layer sandwiched between an outer wall of the square tubing structure and a plate extending along a longitudinal extent of the crossbeam.

30. (Original) The system of Claim 29, wherein characteristics of the elastomer layer and the plate are tuned to increase a natural frequency of the crossbeam structure.

31. (Original) The system of Claim 22, wherein the crossbeam structure is attached to the Y-carriage structure through a squaring plate structure.

32. (Original) The system of Claim 22, further comprising first and second gosset members attached between the Y-carriage structure and the crossbeam to increase stiffness of the T-bar structure.

33. (Original) The system of Claim 14, further comprising a plurality of low impact pressure foot systems, each carried by one of said plurality of spindles, each pressure foot system for applying a clamping force against a surface of a work piece during a drilling stroke, each pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke spaced above the work piece;

a movable clamp member carried by the body structure; and

an actuator for applying a clamp force to move the clamp member against the surface of the work piece at commencement of a drilling stroke and moving the clamp member away from the surface at the end of a drilling stroke.

34. (Original) The system of Claim 33, wherein the clamp member is a relatively low mass finger element having an opening formed therein to allow passage of the drill bit during a drilling stroke, said finger element hingedly connected to the body structure.

35. (Original) The system of Claim 34, wherein the actuator comprises a pneumatic valve and an inflatable bladder element, the valve for selectively inflating and deflating the bladder element to apply the clamp force.

36. (Original) The system of Claim 33, further comprising a Z-axis actuator for moving the pressure foot body along the Z-axis relative to the spindle to position the pressure clamp member at a position spaced by a distance from the work piece surface during a work piece drilling sequence.

37. (Original) The system of Claim 36, wherein said Z-axis actuator is responsive to a sensor signal to stop the movement of the pressure foot body at said distance.

38. (Original) The system of Claim 37, wherein said distance is 0.020 inch or smaller.

39. (Currently Amended) A low impact pressure foot system for a drilling spindle for applying a clamping force against a surface of a work piece during a drilling stroke, the pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke relative to the work piece;

a movable clamp member carried by the body structure;

a sensor for detecting and generating a sensor signal indicative of a close proximity or contact condition of the movable clamp member relative to the surface of the work piece; and

an actuator system for moving the movable clamp member toward the surface of the work piece under a low impact force until the clamp member comes into contact with the surface of the work piece, and in response to said sensor signal, while holding the clamp member in a substantially stationary position relative to the surface of the work piece, ~~for~~ applying a clamp force greater than said low impact force ~~to move~~ with the clamp member against the surface of the

work piece ~~at commencement of~~ during a drilling stroke, and for moving the clamp member away from the surface at the end of a drilling stroke.

40. (Currently Amended) ~~The system of Claim 39~~ A low impact pressure foot system for a drilling spindle for applying a clamping force against a surface of a work piece during a drilling stroke, the pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke relative to the work piece;

a movable clamp member carried by the body structure, wherein the clamp member is a relatively low mass finger element having an opening formed therein to allow passage of the drill bit during a drilling stroke, said finger element hingedly connected to the body structure; and

an actuator for applying a clamp force to move the clamp member against the surface of the work piece at commencement of a drilling stroke and moving the clamp member away from the surface at the end of a drilling stroke.

41. (Currently Amended) ~~The system of Claim 39~~ A low impact pressure foot system for a drilling spindle for applying a clamping force against a surface of a work piece during a drilling stroke, the pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke relative to the work piece;

a movable clamp member carried by the body structure; and

an actuator for applying a clamp force to move the clamp member against the surface of the work piece at commencement of a drilling stroke and moving the clamp member away from the surface at the end of a drilling stroke, wherein the actuator comprises a pneumatic valve and an inflatable bladder element, the valve for selectively inflating and deflating the bladder element to apply the clamp force.

42. (Currently Amended) ~~The system of Claim 39, further comprising~~ A low impact pressure foot system for a drilling spindle for applying a clamping force

against a surface of a work piece during a drilling stroke, the pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke relative to the work piece;

a movable clamp member carried by the body structure;

an actuator for applying a clamp force to move the clamp member against the surface of the work piece at commencement of a drilling stroke and moving the clamp member away from the surface at the end of a drilling stroke; and

a Z-axis actuator for moving the pressure foot body along the Z-axis relative to the spindle to position the pressure clamp member at a position spaced by a distance from the work piece surface during a work piece drilling sequence.

43. (Original) The system of Claim 42, wherein said Z-axis actuator is responsive to a sensor signal to stop the movement of the pressure foot body at said distance.

44. (Original) A drilling system, comprising:

a stationary base table for supporting a work piece under process at a fixed position at a drilling spindle station;

a drilling spindle for carrying and applying rotational force to a drilling tool;

a compound overhead guiding system that carries the spindle above the work piece under process, said system including a Y-axis guiding structure for guiding movement of the spindle along a Y axis in relation to the base table, an X drive system for driving the spindle along an X axis which is orthogonal to said Y axis, and a Z axis drive system for driving the drilling tool along a Z axis which is orthogonal to said X and Y axis;

said guiding system comprising a lightweight crossbeam structure for carrying the spindle and X axis drive system, said crossbeam structure comprising a laminated assembly having a high stiffness-to-weight ratio in relation to a cast iron crossbeam construction.

45. (Original) The system of Claim 44, wherein the Z axis drive system comprises a linear Z-axis drive motor which acts on a spindle rotor to drive the rotor along the Z-axis relative to a stationary spindle body.

46. (Original) The system of Claim 44, wherein the compound overhead guiding system comprises:

a movable overhead Y-carriage structure which is bearing mounted relative to the base table for translating movement along the Y-axis.

47. (Original) The system of Claim 44, wherein the guiding structure comprises a T-bar structure which includes:

a Y-carriage structure having a longitudinal extent along the Y axis; and

said crossbeam structure, wherein said crossbeam structure is perpendicularly attached to the Y-carriage structure and has a longitudinal extent along the X axis.

48. (Original) The system of Claim 44, wherein the crossbeam structure comprises a first hollow structural element comprising a thin-walled round tubing structure, and a second hollow structural element comprising a thin-walled square tubing structure, the round tubing structure fitted into the square tubing structure so that an outer surface of the round tubing structure is in tangential contact with an inner surface of the square tubing structure.

49. (Original) The system of Claim 44, further comprising a low impact pressure foot system carried by said spindle for applying a clamping force against a surface of a work piece during a drilling stroke, the pressure foot system comprising:

a body structure which remains in a stationary position during each drilling stroke spaced above the work piece;

a movable clamp member carried by the body structure; and

an actuator for applying a clamp force to move the clamp member against the surface of the work piece at commencement of a drilling stroke and moving the clamp member away from the surface at the end of a drilling stroke.

50. (Original) The system of Claim 49, wherein the clamp member is a relatively low mass finger element having an opening formed therein to allow passage of the drill bit during a drilling stroke, said finger element hingedly connected to the body structure.

51. (Original) The system of Claim 49, wherein the actuator comprises a pneumatic valve and an inflatable bladder element, the valve for selectively inflating and deflating the bladder element to apply the clamp force.

52. (New) The system of Claim 39, wherein said actuator comprises a pneumatic actuator, and said sensor signal triggers an increase in pressure from a low pressure in said actuator to a high pressure in said actuator to apply said clamping force.